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NASA CR-

144552

COMPUTER PROGRAM
DESIGN SPECIFICATIONS
FOR THE
BALLOON-BORNE ULTRAVIOLET STELLAR SPECTROMETER (BUSS)
SCIENCE DATA DECOMMUTATION PROGRAM
(BAPS48)
Program Q938

Job Order 83-157

(NASA-CR-144552) COMPUTER PROGRAM DESIGN
SPECIFICATIONS FOR THE BALLOON-BORNE
ULTRAVIOLET STELLAR SPECTROMETER (BUSS)
SCIENCE DATA DECOMMUTATION PROGRAM (BAPS48)
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Prepared By

Lockheed Electronics Company, Inc
Aerospace Systems Division
Houston, Texas

Contract NAS 9-12200

For

INSTITUTIONAL DATA SYSTEMS DIVISION



National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

October 1975

LEC-6888

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October 1975

TECHNICAL REPORT INDEX/ABSTRACT (See instructions on reverse side.)	
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11.1.100. DOCUMENT CONTRACT REFERENCES	11.2.100. HARDWARE CONFIGURATION
13. ABSTRACT The Balloon-Borne Ultraviolet Stellar Spectrometer (BUSS) Science Data Decommutation Program (BAPS48) is a pulse code modulation (PCM) decommutation program that will format the BUSS science data contained on a one-inch PCM tracking tape into a seven-track serial bit stream formatted digital tape.	
14. SUBJECT TERMS	
Decommutation	BUSS
Serial	Serial bit stream

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ABBREVIATIONS AND ACRONYMS

BAPS48	BUSS Science Data Decommuation Program
BCD	Binary-coded decimal
BPI	Bits per inch
BUSS	Balloon-Borne Ultraviolet Stellar Spectrometer
GENDES	Data Distribution Generation Program
LSB	Least significant bit
MSB	Most significnat bit
PCM	Pulse code modulation
PDC	Programmed data channel
SBS	Serial bit stream

1. PROGRAM PURPOSE

The Balloon-Borne Ultraviolet Stellar Spectrometer (BUSS) Science Data Decommutation Program (BAPS48) will be a pulse code modulation (PCM) decommutation program. The program will decommutate the BUSS science data contained on 1-inch analog tapes and output on seven-track serial bit stream (SBS) formatted digital tapes.

2. PROGRAM IDENTIFICATION

Title: Balloon-Borne Ultraviolet Stellar Spectrometer (BUSS) Science Data Decommutation Program

Acronym: BAPS48

Program number: Q938

Author: Rodolfo M. Rodriguez

Installation: JSC, Houston, Texas

Program type: Main

Authorization: Contract number NAS 9-12200

Source language: COMPASS32

Computer: CDC 3200/CDC programmed data channel (PDC)

Operating system: CDC 3200 Real-Time Scope

3. ANALYSIS

BAPS48 will input 48 kilobit science data from the PCM subsystem, utilizing the CDC 3200 programmed data channel (PDC) and time code information from the timing subsystem. Time and data will be output in SBS format. BAPS48 will optionally interrogate the line counter and status word and accept data scans when one of the following conditions is present.

- The six most significant bits (MSB) of the line counter (10 through 15) are all zeros.

- Bit 6 (deflection on) of the status word is on.
- Bit 7 (deflection normal) of the status word is on.

One scan per record will be output. Information variables, such as number of frames processed, sync status, time status, etc., will be written on the typewriter. Jump switch 5 will be used to inhibit the connection of the PDC and PCM system. Jump switch 2 will be used to inhibit the writing of data to the SBS output tape.

4. INPUT DESCRIPTION

The input data will consist of a PCM test tape, simulated data for preliminary evaluation of the program, and data descriptor cards used by the Data Descriptor Generation Program (GENDES) to create a data descriptor.

4.1 PCM TEST TAPE

The BUSS PCM data tape will be a Delayed Modulation-Mark (Miller) encoded 14-track PCM tape, 1 inch wide, and recorded at 30 inches per second in the direct mode to yield a 48-kilobit rate. IRIG B timing and a 50-kilohertz reference will also be directly recorded on separate tracks. Data will be recorded in eight-bit bytes with the least significant bit (LSB) first.

The PCM format will consist of the following words, in chronological order:

- 32-bit synchronization word
- 16-bit line counter word
- 16-bit status word
- 1,016 eight-bit words scientific data (one raster)
- 32-bit check word
- 16-bit line counter word
- 16-bit status word

The last three items will be repeated 16 times to form a total frame length of 1,152 eight-bit words.

The synchronization word will be:

MSB	LSB
11111010111100110011010000000000	

and will be transmitted LSB first, eight bits at a time, starting at the least significant eight-bit byte.

The check word will be:

MSB	LSB
00000101000011001100101100000000	

and will be transmitted in the same manner as the sync word.

The 10 least significant bits will indicate the status of the line counter.

The status word bits will have the following meanings:

- bit 15 (MSB) - spare (logic 0)
- bit 14 - spare
- bit 13 - spare
- bit 12 - spare
- bit 11 - spare
- bit 10 - erase lamp on
- bit 9 - target voltage erase
- bit 8 - target voltage readout
- bit 7 - deflection normal
- bit 6 - deflection on
- bit 5 - focus current on
- bit 4 - photocathode voltage on
- bit 3 - readout high voltages on
- bit 2 - heater and alignment on
- bit 1 - stepping motor
- bit 0 (LSB) - shutter open

4.2 SIMULATED DATA

The stored program simulator will be used to generate simulated test data to evaluate the preliminary performance of the program. The format of the simulated data that will be used is illustrated in figure 1.

4.3 DATA DESCRIPTOR CARDS

Input cards will describe each measurement for GENDES, which will write the descriptor file on the first tape at the beginning of each decommutation job. Figure 2 shows a listing of the data descriptor cards.

5. OUTPUT DESCRIPTION

The output will consist of a SBS formatted digital tape and the typewriter log.

5.1 OUTPUT DIGITAL TAPE

The output tape will be a standard SBS format consisting of time and data scans. It will contain a data descriptor in file 1 generated by GENDES. File 2 will contain the science data and will be recorded at one scan of data per record. Each record will contain 522 24-bit words per record, which is equivalent to 348 36-bit words per record or 261 48-bit words per record. A description of the science data record format is found in figure 3.

The tape will have the following characteristics:

- Seven-track magnetic digital tape
- 800 bits per inch (BPI) odd parity
- One scan per record
- 522 24-bits words/record

SIMULATED DATA

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<u>Pin</u>	<u>Eight-bit octal simulator output value</u>	<u>Eight-bit octal converted value</u>	<u>Comments</u>	
0	000	000	} Sync	
1	054	064		
2	317	363		
3	137	372		
4	000	000	} LCOUNT	Simulated value varies 0-1023
5	000	000		
6	237	371	} Status	
7	257	365		
8	200	001	DATA1	
9	100	002	DATA2	
10	003	300	DATA3	
.	.	.	.	} Simulated value repeated and incremented by 1, 111 times.
.	.	.	.	
.	.	.	.	
121	162	116	DATA114	
122	316	163	DATA115	
.	.	.	.	} Repeated 963 times
.	.	.	.	
.	.	.	.	
1022	316	163	DATA1015	
1023	056	164	DATA1016	
1024	000	000	} CKWORD	
1025	323	313		
1026	060	014		
1027	240	005		
1028	000	000	} LCOUNT2	
1029	000	000		
1030	237	371	} STATUS2	
1031	257	365		
.	.	.	} Fill-repeated 119 times	
.	.	.		
.	.	.		
1150	257	165		
1151	236	171	LAST varies 121 to 139*	

*Every 20 cycles the following conditions occur:

LAST = 145 Normal
 146 Normal
 147 Out-of-sync
 148 Normal
 149 Out-of-sync
 149 Normal
 150 Status bit 9 off for previous 20 cycles
 151 Normal

NOTE: The RAPS48 data will be received LSB first in eight-bit words. The simulated program has been designed to reflect this characteristic. The simulated value seen by the PCM will be LSN first. The RAPS48 program will invert these and output the converted value.

Figure 1. - Format of the simulated data.

DAYS	24	0	0	1	1	1	2	2
YEAR1	24	0	0	1	1	1	2	2
TIME1	48	0	1	3	1	1	4	4
SYNCL	3	45	1	3	1	1	0	4
SYNCS	3	42	5	3	1	1	0	4
SYNCS	3	39	5	3	1	1	0	4
INDEX	9	33	5	3	1	1	0	4
SYNCHORD	32	0	5	3	1	1	4	4
ENDHEADER								
LCOUNT1	8	4	5	0	1	1	1	4
LCOUNT2	8	4	5	0	1	1	1	5
STATUS1	8	4	5	0	1	1	1	6
STATUS2	8	4	5	0	1	1	1	7
DATA1	8	4	5	0	1	1	1	8
DATA2	8	4	5	0	1	1	1	9
DATA3	8	4	5	0	1	1	1	10
DATA4	8	4	5	0	1	1	1	11
DATA5	8	4	5	0	1	1	1	12
DATA6	8	4	5	0	1	1	1	13
DATA7	8	4	5	0	1	1	1	14
DATA8	8	4	5	0	1	1	1	15
DATA9	8	4	5	0	1	1	1	16
DATA10	8	4	5	0	1	1	1	17
DATA11	8	4	5	0	1	1	1	18
DATA12	8	4	5	0	1	1	1	19
DATA13	8	4	5	0	1	1	1	20
DATA14	8	4	5	0	1	1	1	21
DATA15	8	4	5	0	1	1	1	22
DATA16	8	4	5	0	1	1	1	23

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Figure 2. - Listing of the data descriptor cards.

	47		23	0
WORD				
1	DAYS (BCD)		YEAR (BCD)	
2	DATAQUAL			
3	TIME1			
4	6Y SYNCH	64 SYNCH	61 SYNCH	81 SYNCWORD
5	Lcount1	Lcount2	Status1	Status2
6	Data1	Data2	Data3	Data4
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
259	Data1013	Data1014	Data1015	Data1016
260	Ckword1	Ckword2	Ckword3	Ckword4
261	Lcount11	Lcount22	Status11	Status22

The terms in the record are defined as follows:

- DATAQUAL = -0
- TIME1 = Binary milliseconds, 36 bits right-justified in 48 bits
- SYNC1 = Timing status indicator
- SYNC5 = Main frame sync indicator
- SYNCWORD = 32-bit synchronization word
- LCOUNT = 16-bit line counter word
- STATUS = 16-bit status word
- DATA = 1016 eight-bit scientific data word
- CKWORD = 32-bit check word

- 1 Scan/record
- 261 48-bit words/record
(348 36-bit words/record)
(522 24-bit words/record)

8

- Nonlabeled
- Non-FORTRAN-compatible, buffered output

The data file will be contained on continuation reels, if needed, until the standard two end-of-file markers signal the end of data.

5.2 TYPEWRITER LOG

The typewriter log will be the standard information message produced by decommutation programs. The parameters that the information message will display are shown in figure 4.

6. RESTRICTIONS

This program is designed to run on a CDC 3200 equipped with a program data channel and telemetry equipment.

7. DIAGNOSTICS

All information about program condition will be presented by the information message. No special diagnostic messages will be printed.

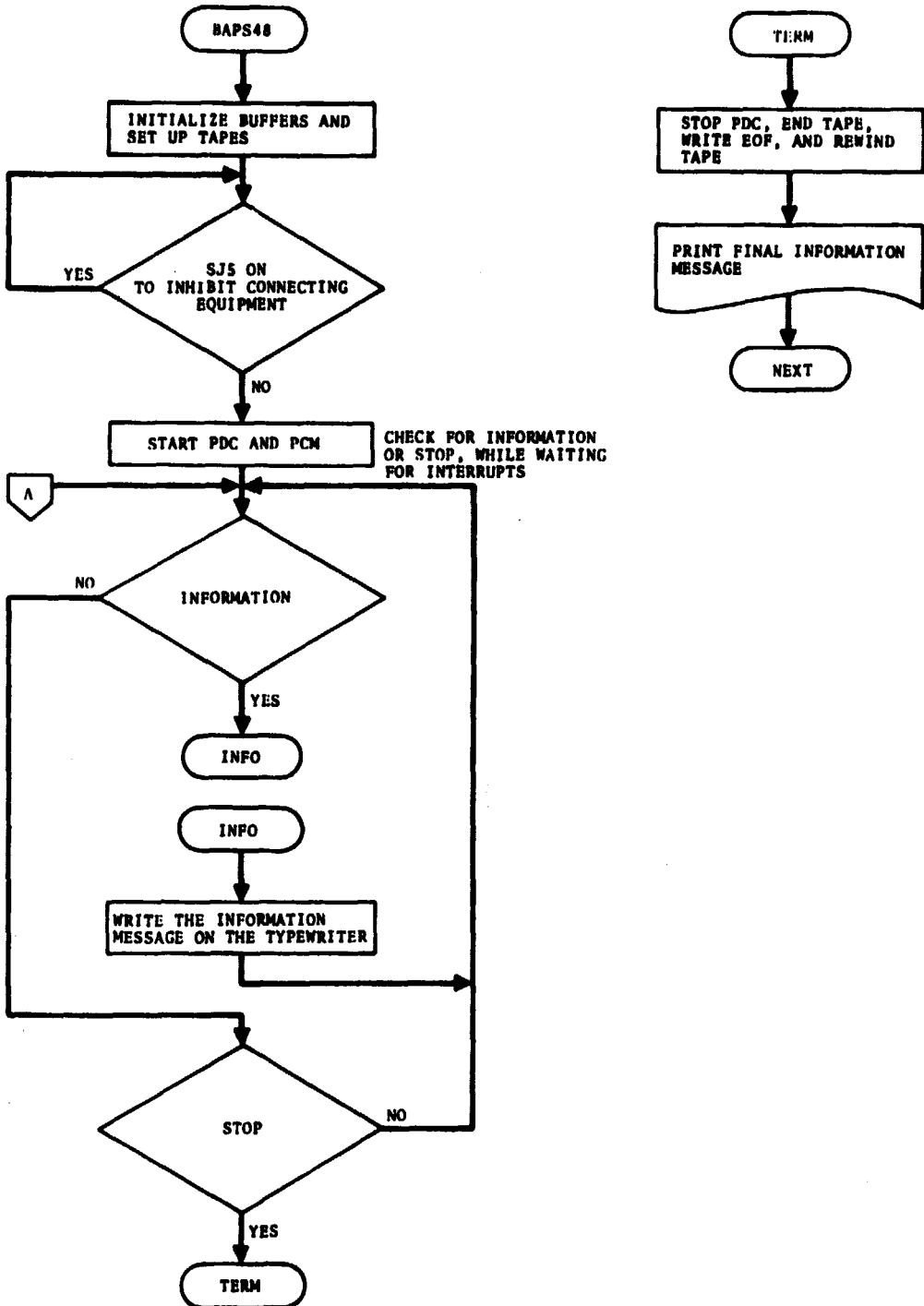
SYNC	OFF	0	3	48820	173	48652	0	1083	0
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)

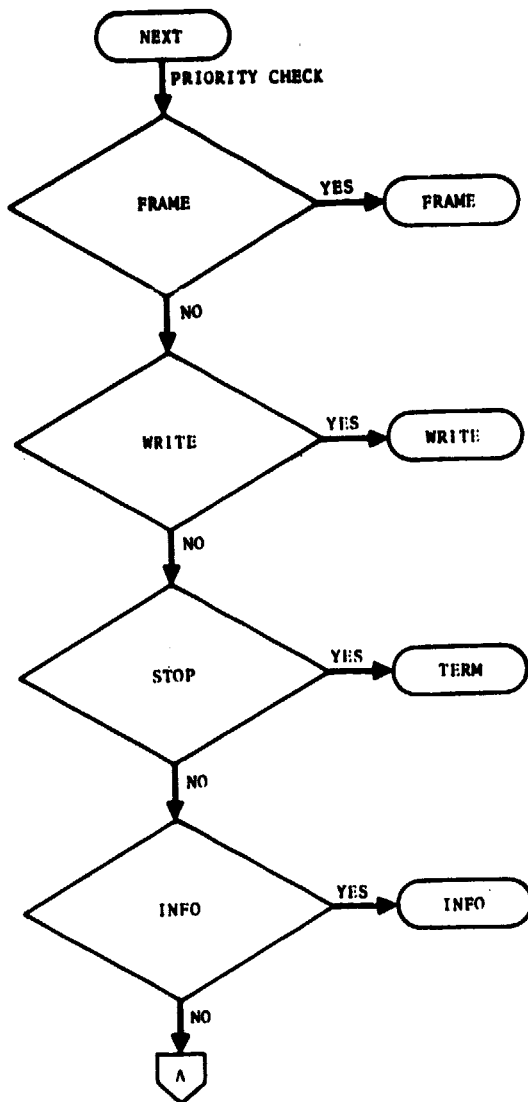
NOTES:

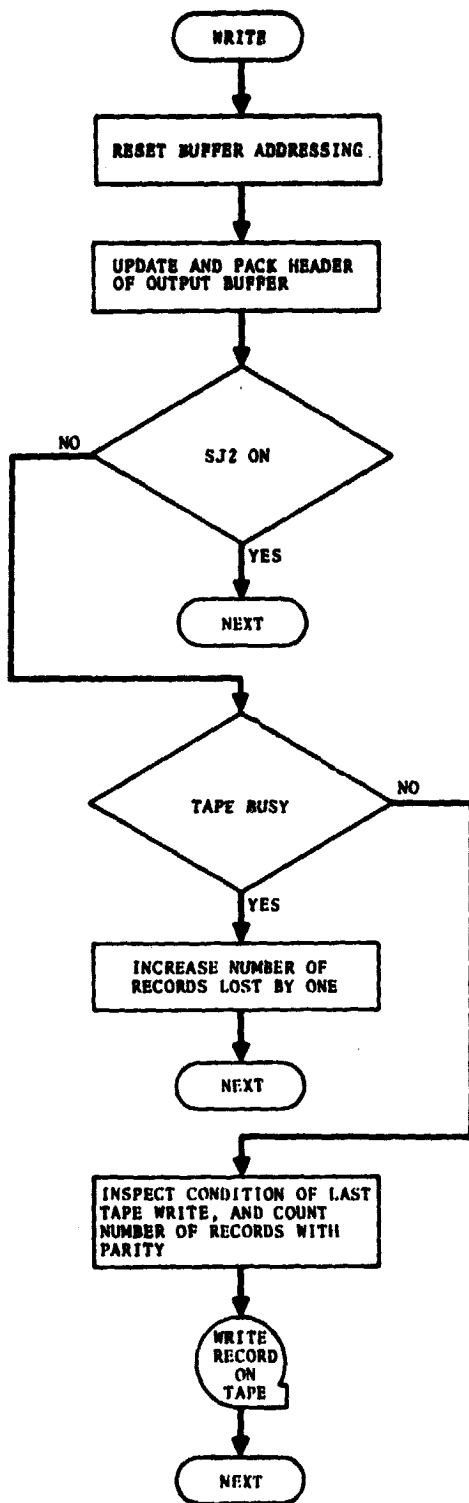
- (a) Main frame synchronization status: SRCH - search mode
VERF - verification mode
SYNC - synchronization mode
- (b) Present position of sense switch 2
- (c) Number of times that synchronization has been lost and a return to search mode has been made
- (d) Total number of frames deleted as a result of status word check
- (e) Total number of frames processed
- (f) Total number of frames with bad or questionable time status
- (g) Total number of frames with good time status
- (h) Total number of actual time jumps according to status lines
- (i) Current number of records written on tape
- (j) Current number of records lost

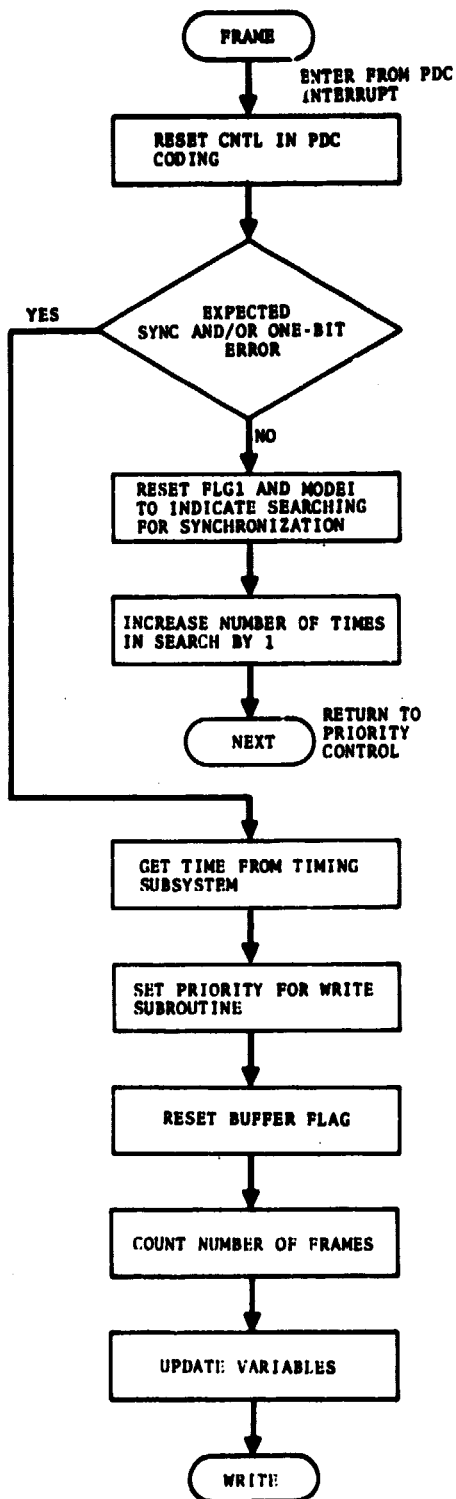
Figure 4. - Information message description of the typewriter log.

8. PROGRAM FLOW CHART









9. EQUIPMENT REQUIREMENTS

The equipment requirements for this program will be as follows:

- CDC 3200 computer system with console typewriter
- CDC programmed data channel (PDC)
- Tape drives
- Card reader
- Line printer
- Timing subsystem
- PCM subsystem
- Analog tape transport (1 inch)
- Simulator system (needed for preliminary testing)